1. A roller coaster can rapidly picks up velocity as it rolls down a slope. As it starts down the slope, its velocity is 4 m/s [downward]. But 3 seconds later, at the bottom of the slope, its velocity is 22 m/s [downward]. What is its average acceleration?

\[ \Delta V = V_f - V_i \]
\[ = (22) - (-4) \]
\[ = 18 \text{ m/s} \]

\[ a = \frac{\Delta V}{\Delta t} = \frac{-18 \text{ m/s}}{3 \text{ s}} = -6 \text{ m/s}^2 \]

2. A car accelerates at a rate of 3.0 m/s² [N]. If its original velocity is 8.0 m/s [N], how many seconds will it take the car to reach a final velocity of 25.0 m/s [N]?

\[ \Delta V = V_f - V_i \]
\[ = (25) - (8.0) \]
\[ = 17 \text{ m/s} \]

\[ a = \frac{\Delta V}{\Delta t} = \frac{17 \text{ m/s}}{3.0 \text{ m/s}^2} = 5.7 \text{ s} \]

3. A cyclist accelerates from 0 m/s [E] to 8 m/s [E] in 3 seconds. What is his acceleration? Is this acceleration higher than that of a car which accelerates from 0 to 30 m/s [E] in 8 seconds?

\[ \vec{a} = \frac{8 - 0}{3} \]
\[ = \frac{8}{3} \text{ m/s}^2 \text{ [E]} \]

\[ \vec{a} = \frac{30 - 0}{8} \]
\[ = \frac{30}{8} \text{ m/s}^2 \text{ [E]} \]

No

4. The final velocity of a car is 30 m/s [S]. The car is accelerating at a rate of 2.5 m/s² [S] over an 8 second period of time. What is the initial velocity of the car?

\[ \Delta V = (a)(\Delta t) \]
\[ = (-2.5 \text{ m/s}^2)(8 \text{ s}) \]
\[ = -20 \text{ m/s} \]

\[ V_i = V_f - \Delta V \]
\[ = (-30) - (-20) \]
\[ = -10 \text{ m/s} \]

5. If a car, with an initial velocity of 10 m/s [W], accelerates at a rate of 50 m/s² [W] for 3 seconds, what will its final velocity be?

\[ \Delta V = (a)(\Delta t) \]
\[ = (-50 \text{ m/s}^2)(3 \text{ s}) \]
\[ = -150 \text{ m/s} \]

\[ V_f = V_i + \Delta V \]
\[ = (-10 \text{ m/s}) + (-150 \text{ m/s}) \]
\[ = -160 \text{ m/s} \]

[160 m/s [W]]
6. A car traveling at a velocity of 30.0 m/s encounters an emergency and comes to a complete stop. How much time will it take for the car to stop if its rate of deceleration is -4.0 m/s²?

\[ \Delta V = V_f - V_i \]
\[ \Delta t = \frac{\Delta V}{a} \]
\[ = 0 - 30 \]
\[ = -30 \text{ m/s} \]
\[ \frac{-30 \text{ m/s}}{-4.0 \text{ m/s}^2} = 7.5 \text{ s} \]

7. A cart is rolling down an incline for 5.0 seconds has an acceleration of 4.0 m/s² [N]. If the cart has a beginning velocity of 2.0 m/s [N], what is its final velocity?

\[ \Delta V = (a)(at) \]
\[ = (+4.0 \text{ m/s}^2)(5.0 \text{ s}) \]
\[ = +20 \text{ m/s} \]
\[ V_f = V_i + \Delta V \]
\[ = (+2.0 \text{ m/s}) + (+20 \text{ m/s}) \]
\[ = +22 \text{ m/s [N]} \]

8. A parachute on a racing dragster opens and changes the velocity of the car from 85 m/s [E] to 45 m/s [E] in a period of 4.5 seconds. What is the acceleration of the dragster?

\[ \Delta V = V_f - V_i \]
\[ = (+45 \text{ m/s}) - (+85 \text{ m/s}) \]
\[ = -40 \text{ m/s} \]
\[ a = \frac{\Delta V}{\Delta t} \]
\[ = \frac{-40 \text{ m/s}}{4.5 \text{ s}} \]
\[ = -8.89 \text{ m/s}^2 [E] \]

9. A motorcycle traveling at +25 m/s accelerates at a rate of +7.0 m/s² for 6.0 seconds. What is the final velocity of the motorcycle?

\[ \Delta V = (a)(at) \]
\[ = (+7.0 \text{ m/s}^2)(6.0 \text{ s}) \]
\[ = +42 \text{ m/s} \]
\[ V_f = V_i + \Delta V \]
\[ = (+25 \text{ m/s}) + (+42 \text{ m/s}) \]
\[ = +67 \text{ m/s} \]

10. A skier accelerates at a rate of 4.6 m/s² [N] for 4.5s. What is his initial velocity if his final velocity is 21 m/s [N]?

\[ \Delta V = (a)(at) \]
\[ = (+4.6 \text{ m/s}^2)(4.5 \text{ s}) \]
\[ = +20.7 \text{ m/s} \]
\[ V_i = V_f - \Delta V \]
\[ = (+21 \text{ m/s}) - (+20.7 \text{ m/s}) \]
\[ = +0.3 \text{ m/s [N]} \]